CLAIMS

What is claimed is:

1. A control network system, comprising:

a hierarchical control network, said hierarchical control network comprising a plurality of data buses and a plurality of control network nodes arranged in a hierarchical structure, each of said data buses connected to one or more of said control network nodes; and

a supervisory network, said supervisory network comprising at least one multi-master data bus and a plurality of supervisory nodes connected to said at least one multi-master data bus, each of said supervisory nodes connected to one of said data buses of said hierarchical control network.

2. The control network system of claim 1, wherein one of the control network nodes connected to each of said data buses is configured to operate as a master node and the other control network nodes connected to each of said data buses are configured to operate as slave nodes.

3. The control network system of claim 2, wherein each of said supervisory nodes comprises a supervisory node slave unit and a supervisory node master unit, said supervisory node slave unit connected to one of said data buses of said hierarchical control network, and said supervisory node master unit connected to said at least one multi-master data bus.

4. The control network system of claim 3, wherein the master node for each data bus systematically polls the slave nodes connected to the data bus.

5. The control network system of claim 4, wherein the master node for each data bus polls the supervisory node slave unit of the supervisory node connected to the data bus in connection with polling the slave nodes connected to the data bus.

6. The control network system of claim 5, wherein the supervisory node slave unit of each supervisory node does not transmit a message over the data bus to which the supervisory node is connected unless instructed to by the master node connected to the data bus.

7. The control network of claim 3, wherein the supervisory node master unit of each supervisory node transmits an alert message over said at least one multi-master data bus when the supervisory node slave unit detects an error or exception condition.

8. The control network of claim 7, wherein said alert message is a broadcast message intended for all of the supervisory nodes connected to said at least one multi-master data bus.

9. The control network of claim 7, wherein:

one of said data buses comprises a first-tier data bus;

the master node connected to said first-tier data bus is configured to operate as a first-tier master node;

at least one of said supervisory nodes is connected to said first-tier data bus, said at least one supervisory node being configured to operate as a liaison to said first-tier master node; and

said at least one supervisory node relays information pertaining to said alert message to said first-tier master node upon receipt of said alert message.

10. The control network system of claim 3, wherein each of said control network nodes comprises a control network node slave unit and control network node master unit.

11. The control network system of claim 10, wherein each of said control network nodes comprises a pair of transceivers and a pair of processors, a first one of said pair of transceivers being utilized by said control network node slave unit and a second one of said pair of transceivers being utilized by said control network node master unit, and a first one of said pair of processors being connected to said first one of said pair of transceivers and utilized by

said control network node slave unit and a second one of said pair of processors being connected to said second one of said pair of transceivers and utilized by said control network node master unit.

12. The control network system of claim 11, wherein each of said supervisory nodes comprises a second pair of transceivers and a second pair of processors, a first one of said second pair of transceivers being utilized by said supervisory slave node unit and a second one of said second pair of transceivers being utilized by said supervisory node master unit, and a first one of said second pair of processors being connected to said first one of said second pair of transceivers and utilized by said supervisory node slave unit and a second one of said second pair of processors being connected to said second one of said second pair of transceivers and utilized by said supervisory node master unit.

13. The control network of claim 2, wherein said supervisory nodes communicate over said at least one multi-master data bus according to a multi-master communication protocol.

14. A method of configuring a control network system, comprising the steps of:

connecting a plurality of control network nodes and a plurality of data buses in a hierarchical control network structure;

connecting a plurality of supervisory nodes to said plurality of data buses, each of said plurality of supervisory nodes connected to one of said data buses;

connecting said plurality of supervisory nodes to a multi-master supervisory data bus;

communicating among said control network nodes according to a master-slave communication protocol over each of said plurality of data buses;

monitoring communications over said data buses using said supervisory nodes; and

communicating among said supervisory nodes over said multi-master supervisory data bus according to a multi-master communication protocol.

15. The method of claim 14, wherein said step of connecting said plurality of control network nodes and said plurality of data buses in said hierarchical control network structure comprises the step of connecting each of said data buses to one or more of said control network nodes, and configuring one of the control network nodes attached to a given data bus to operate as a master node and the remainder of the control network nodes attached to the given data bus to operate as slave nodes.

16. The method of claim 15, wherein said step of connecting said plurality of supervisory nodes to said plurality of data buses comprises the step of, for each supervisory node, connecting a supervisory node slave unit to one of said data buses, and wherein the step of connecting said plurality of supervisory nodes to said multi-master supervisory data bus comprises the step of, for each supervisory node, connecting a supervisory node master unit to said multi-master supervisory data bus.

17. The method of claim 16, wherein said step of communicating among said control network nodes according to said master-slave communication protocol over each of said plurality of data buses comprises the step of, for each bus, systematically polling the slave nodes connected to the data bus from the master node connected to the data bus.

18. The method of claim 17, wherein said step of, for each bus, systematically polling the slave nodes connected to the data bus from the master node connected to the data bus comprises the step of polling the supervisory node slave unit connected to the data bus.

19. The method of claim 16, further comprising the step of transmitting an alert message over said at least one multi-master data bus when the supervisory node slave unit detects an error or exception condition on the data bus to which the supervisory node slave unit is attached.

20. The method of claim 19, wherein said alert message is a broadcast message intended for all of the supervisory nodes connected to said at least one multi-master data bus.

21. The method of claim 19, further comprising the step of relaying information contained with said alert message from one of said supervisory nodes to a master node connected to a higher-tier data bus relative to the data bus to which the supervisory node sending the alert message is attached.

22. The method of claim 21, wherein said master node connected to said higher-tier data bus is a first-tier master node.

23. The method of claim 16, wherein each of said control network nodes comprises a control network node slave unit and control network node master unit.

24. The method of claim 23, wherein each of said control network nodes comprises a pair of transceivers and a pair of processors, a first one of said pair of transceivers being utilized by said control network node slave unit and a second one of said pair of transceivers being utilized by said control network node master unit, and a first one of said pair of processors being connected to said first one of said pair of transceivers and utilized by said control network node slave unit and a second one of said pair of processors being connected to said second one of said pair of transceivers and utilized by said control network node master unit.

25. The method of claim 24, wherein each of said supervisory nodes comprises a second pair of transceivers and a second pair of processors, a first one of said second pair of transceivers being utilized by said supervisory slave node unit and a second one of said second pair of transceivers being utilized by said supervisory node master unit, and a first one of said second pair of processors being connected to said first one of said second pair of transceivers and utilized by said supervisory node slave unit and a second one of said second pair of processors being connected to said second one of said second pair of transceivers and utilized by said supervisory node master unit.

26. A control network system, comprising:

a plurality of control network data buses;

a plurality of control network nodes connected to said control network data buses, each of said control network data buses connected to one or more of said control network nodes, and each of said control network nodes comprising an uplink transceiver and a downlink transceiver which is disconnected or else connected to a separate data bus than said uplink transceiver;

a multi-master supervisory data bus; and

a plurality of supervisory nodes connected to said multi-master supervisory data bus, each of said plurality of supervisory nodes also connected to one of said control network data buses.

27. The control network system of claim 26, wherein said supervisory nodes communicate according to a multi-master communication protocol.

28. The control network system of claim 26, wherein one of said control network nodes connected to a given data bus is configured to operate as a master node, and the remainder of said control network nodes connected to the given data bus are configured to operate as slave nodes.

29. The control network system of claim 28, wherein each of said supervisory nodes is configured as a slave node with respect to the data bus to which it is connected.

30. The control network system of claim 29, wherein the master node for each data bus systematically polls each of the slave nodes as well as the supervisory node attached to the data bus.

31. The control network system of claim 29, wherein each of said supervisory nodes monitors the data bus to which the supervisory node is connected, and transmits an error message over said multi-master supervisory data bus when detecting an error or exception condition on the data bus to which the supervisory node is connected.

32. The control network system of claim 31, wherein said error message comprises a broadcast message intended for reception by each of the supervisory nodes connected to the multi-master supervisory data bus.

33. The control network of claim 28, wherein the supervisory node takes over for the master node on the data bus to which the supervisory node is connected upon detecting a failure of the master node.

34. A control network system, comprising:

a plurality of nodes;

a plurality of control network data buses connected to distinct sets of said nodes and arranged in a hierarchical structure, said plurality of control network data buses comprising a first-tier control network data bus and a plurality of lower-tier data buses, each distinct set of nodes comprising a master node and one or more slave nodes;

a multi-master supervisory data bus; and

a plurality of supervisory nodes connected to said multi-master supervisory data bus, each of said supervisory nodes also connected to one of said lower-tier buses, whereby communications on said lower-tier buses are monitored by said supervisory nodes and made accessible to the master node connected to the first-tier control network data bus.

35. The control network of claim 34, wherein each of said supervisory nodes comprises a first transceiver connected to one of said lower-tier data buses, and a second transceiver connected to said multi-master supervisory data bus.

36. A control network system, comprising:

a plurality of nodes;

a plurality of control network data buses connected to distinct sets of said nodes and arranged in a hierarchical structure, said plurality of control network data buses comprising a

first-tier control network data bus and a plurality of lower-tier data buses, each distinct set of nodes comprising a master node and one or more slave nodes; and

a supervisory network, said supervisory network comprising

at least one supervisory data bus; and

a plurality of supervisory nodes connected to said at least one supervisory data bus, each of said supervisory nodes also connected to one of said lower-tier buses, whereby communications on said lower-tier buses are monitored by said supervisory nodes and made accessible to the master node connected to the first-tier control network data bus.

37. The control network system of claim 36, wherein said plurality of supervisory nodes are arranged in a hierarchical network, one of said supervisory nodes connected to said at least one supervisory data bus being configured to operate as a master supervisory node and the remainder of said supervisory nodes connected to said at least one supervisory data bus being configured to operate as slave supervisory nodes.

38. The control network system of claim 37, wherein said at least one supervisory data bus includes a first supervisory data bus and a second supervisory data bus, and wherein said supervisory nodes comprise a second-tier master supervisory node configured to operate as a master node with respect to said second supervisory data bus and to operate as a slave node with respect to said first supervisory data bus.

39. The control network system of claim 36, wherein said at least one supervisory data bus comprises a multi-master supervisory data bus, and wherein each of said slave nodes is configured to operate as a slave node with respect to one of said lower-tier data buses, and as a master node with respect to said multi-master supervisory data bus.